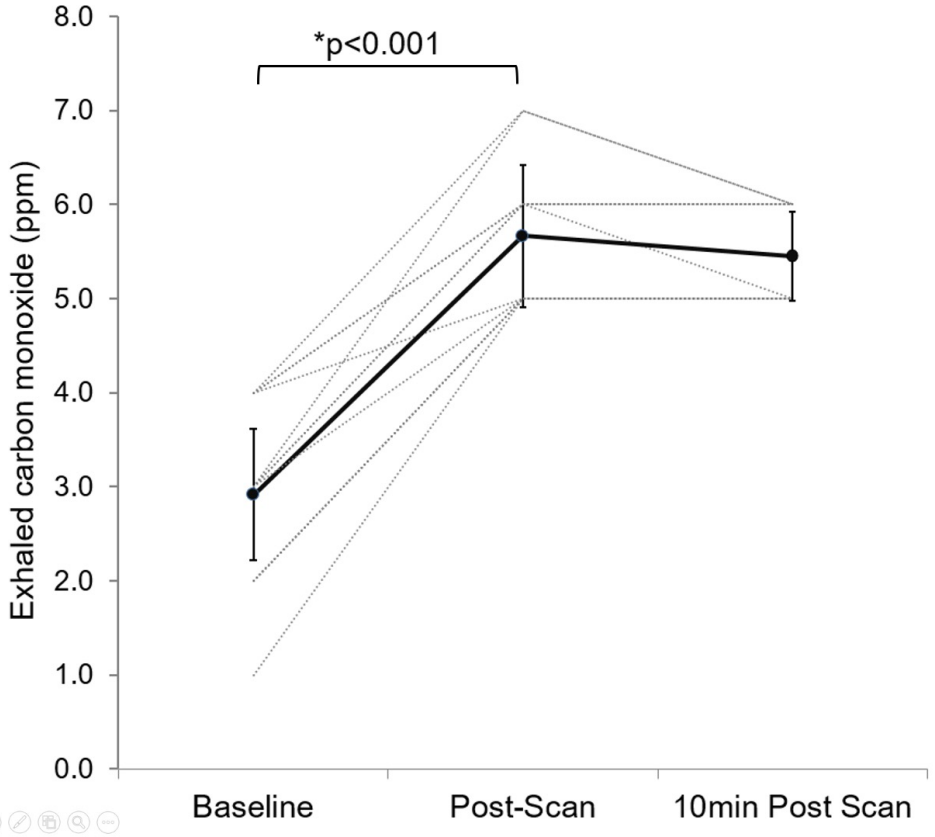
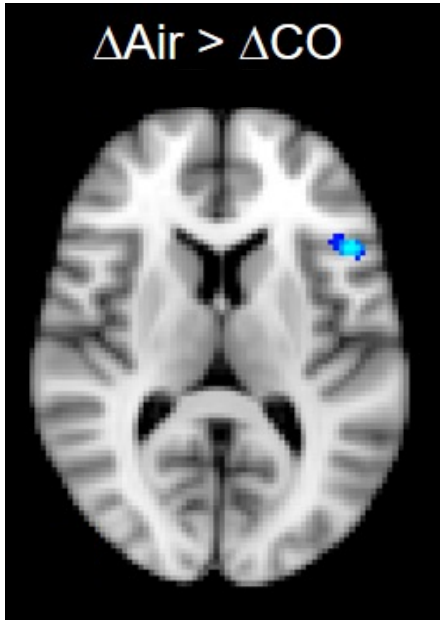
The impact of low-level CO on the adult and developing brain

Dr Mari Herigstad
Sheffield Hallam University

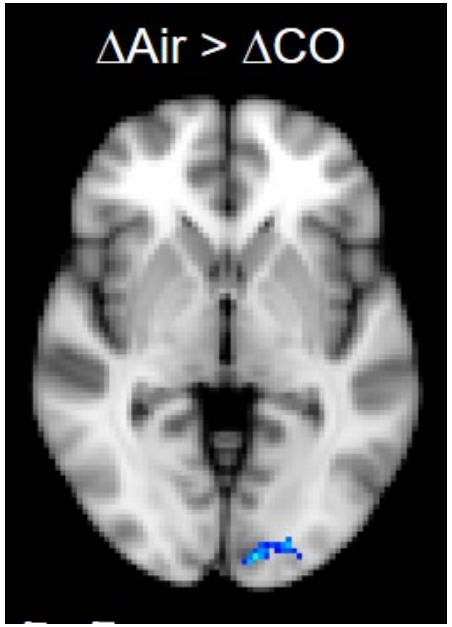
Adult



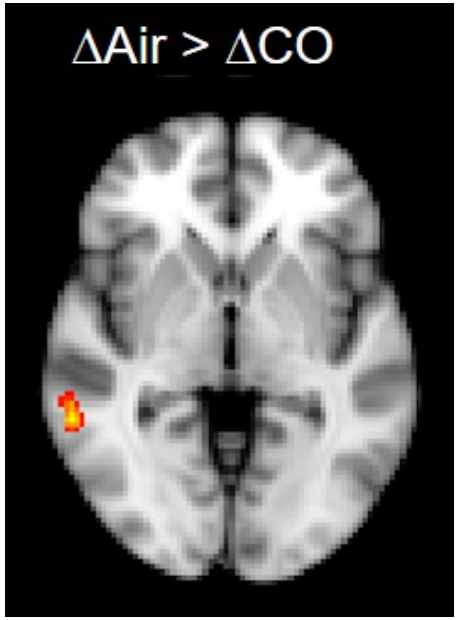
B



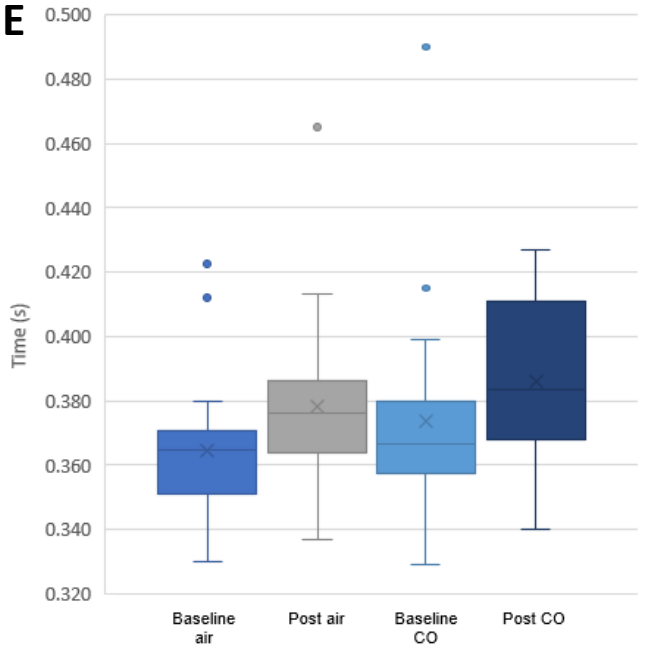
C



D



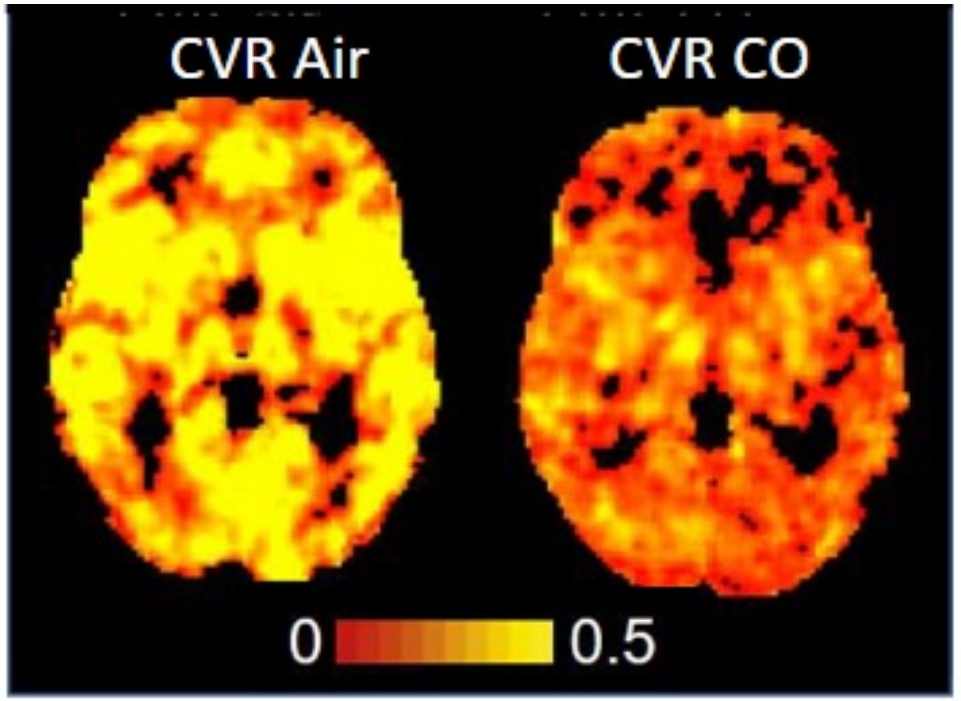
E



(A) Exhaled CO levels, and MRI data showing reduced activation during a (B) breathing task (insula), and (C) visual activation task (visual cortex), from Bendell, Moosavi & Herigstad, J Cereb Blood Flow Metab, 2020;40(11), 2215-2224.; D. MRI activation drop during a reaction time (RT) task (temporal lobe) and E. RT data, air and CO protocol, from Wilson & Herigstad, Biorxiv, 2022, doi: 10.1101/2023.01.17.524443.

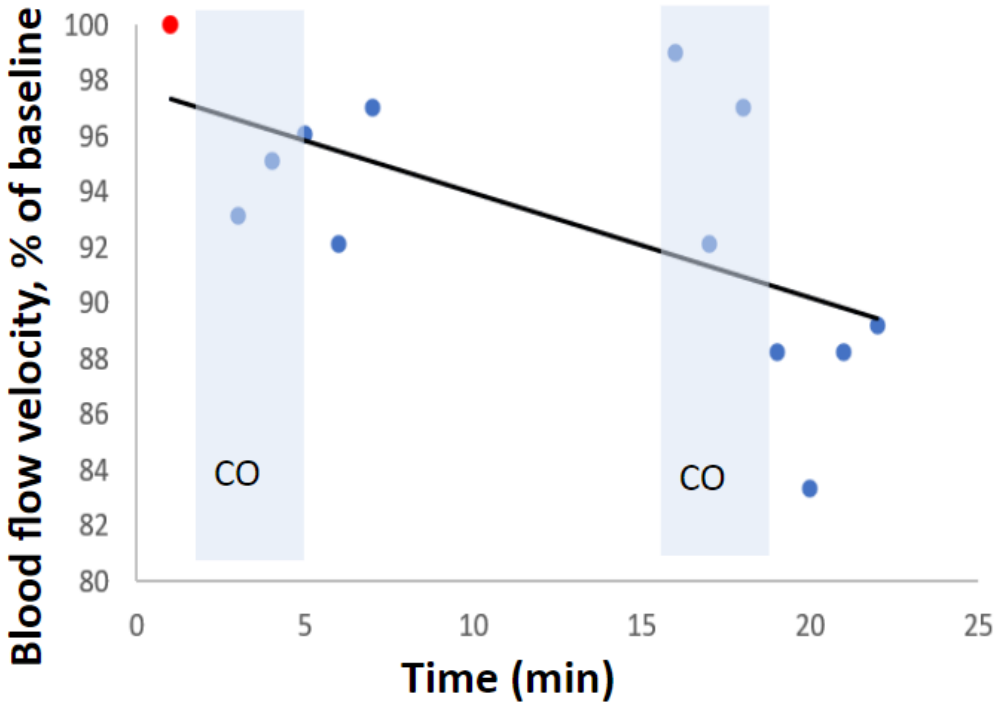
Adult

A



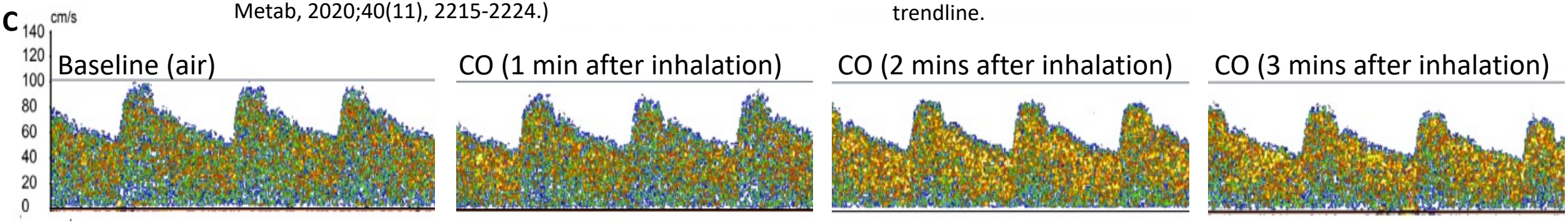
(A) Cerebrovascular Reactivity (CVR) after air and CO inhalation. Red indicates lower and yellow higher CVR. MRI data. (Bendell, Moosavi & Herigstad, J Cereb Blood Flow Metab, 2020;40(11), 2215-2224.)

B



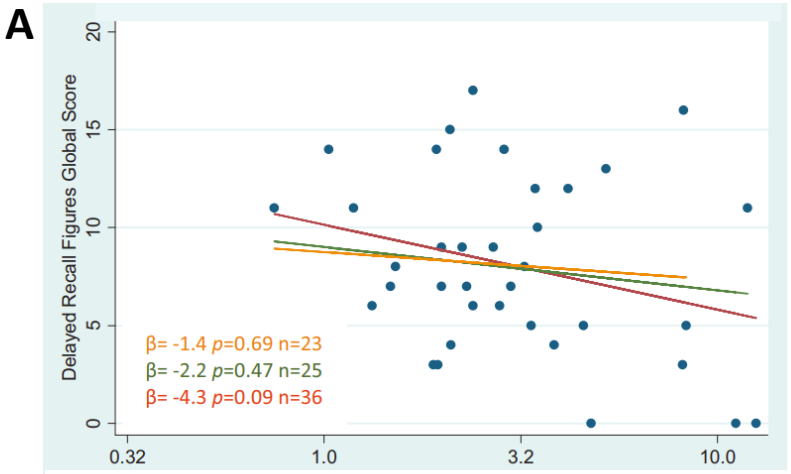
(B) Preliminary data: blood flow velocity at the MCA (shown as % of baseline, red dot) dropping with CO inhalation (3ppm increase in exhaled CO), as measured by TCD. Individual data points and trendline.

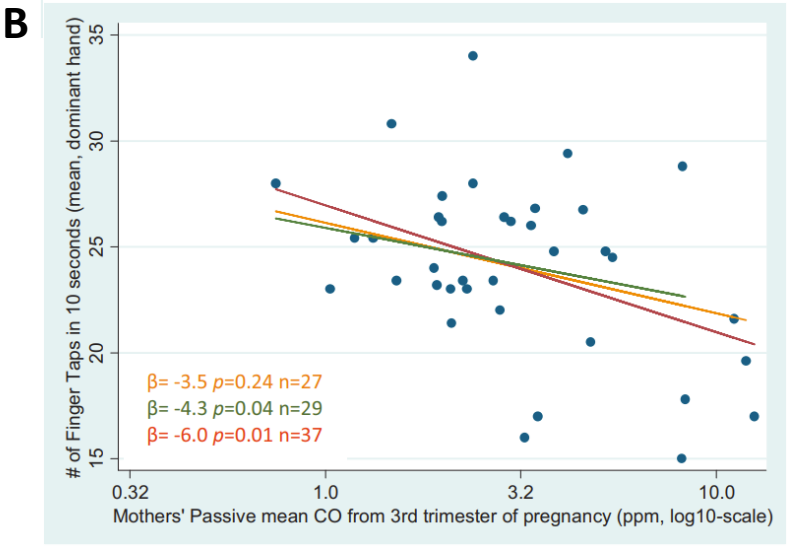
C



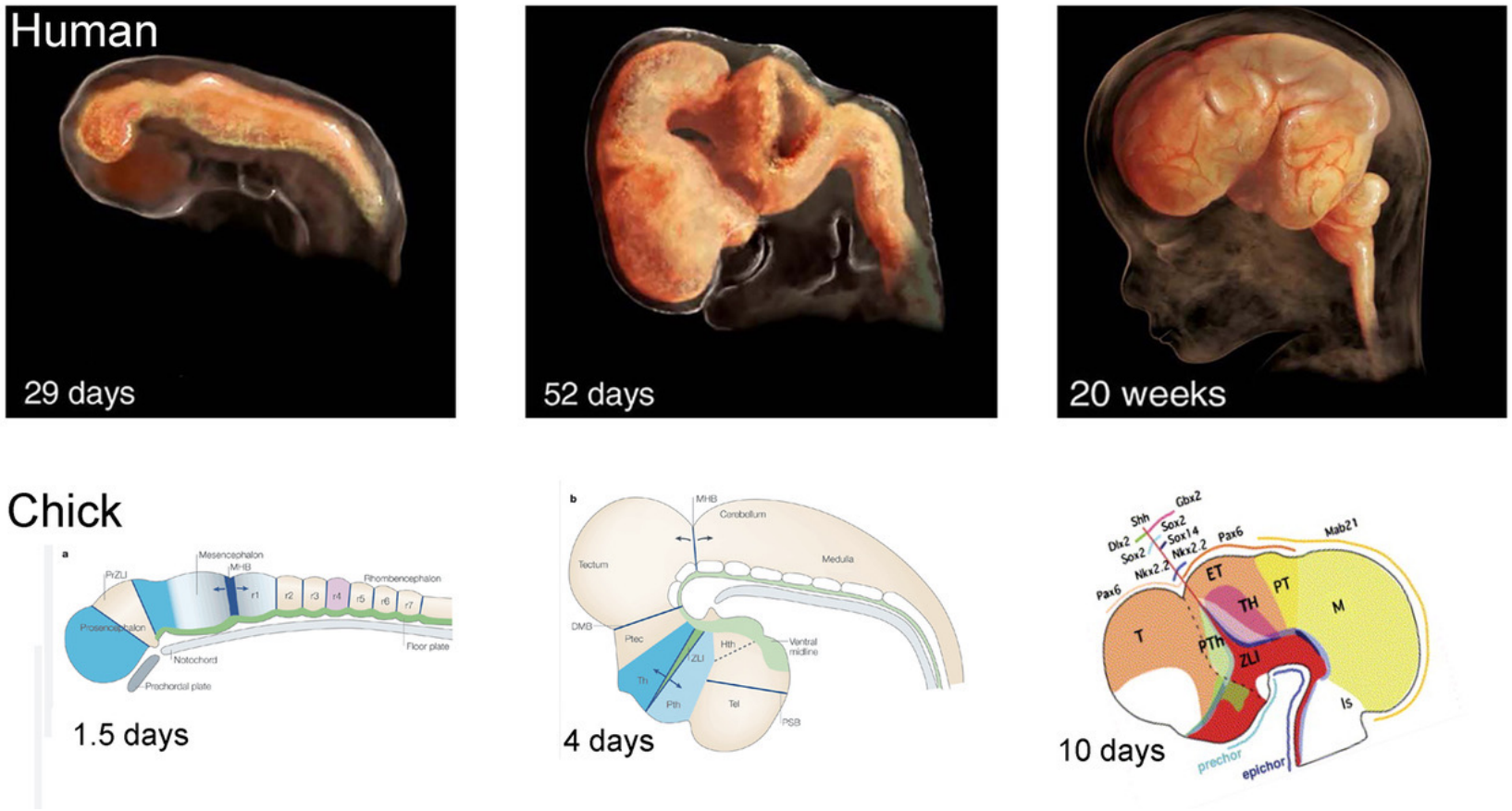
(C) Preliminary data: velocity profiles from the MCA at set timepoints following CO inhalation (3ppm increase in exhaled CO), measured by TCD. Horisontal bar indicates baseline values (approx. 100 cm/s)

Development





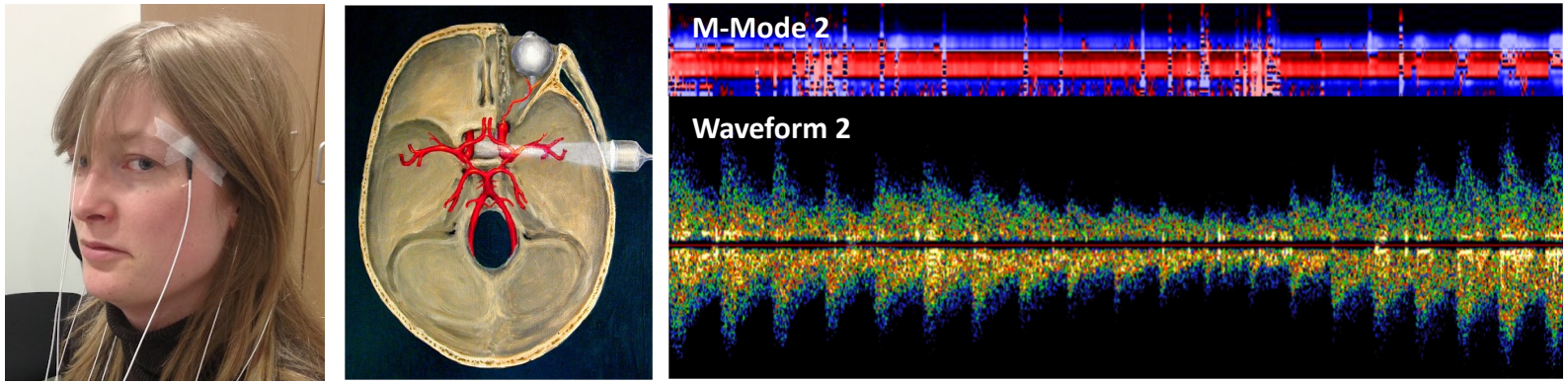
Neurodevelopmental performance, (A) recall and (B) motor skills correlate with maternal CO exposure (3.8+/-3.0ppm), from Dix-Cooper et al., Neurotoxicology, 2012;33(2):246-54.



(C) Morphological features of the developing human and chick brain. Top panels: fMRI images of human foetuses show morphological features of brain at 7-20 weeks. Adapted from Konkel (2018). Bottom panels: Schematics show morphological features of chick brain at embryonic days 1.5-10. Note similarities to human. In panel 2, specific brain regions are labelled; in panel 3, typical markers used to characterise diencephalon, prethalamus and thalamus are shown. Adapted from Kiecker & Lumsden, Nat Rev Neurosci, 2005;6(7):553-64.

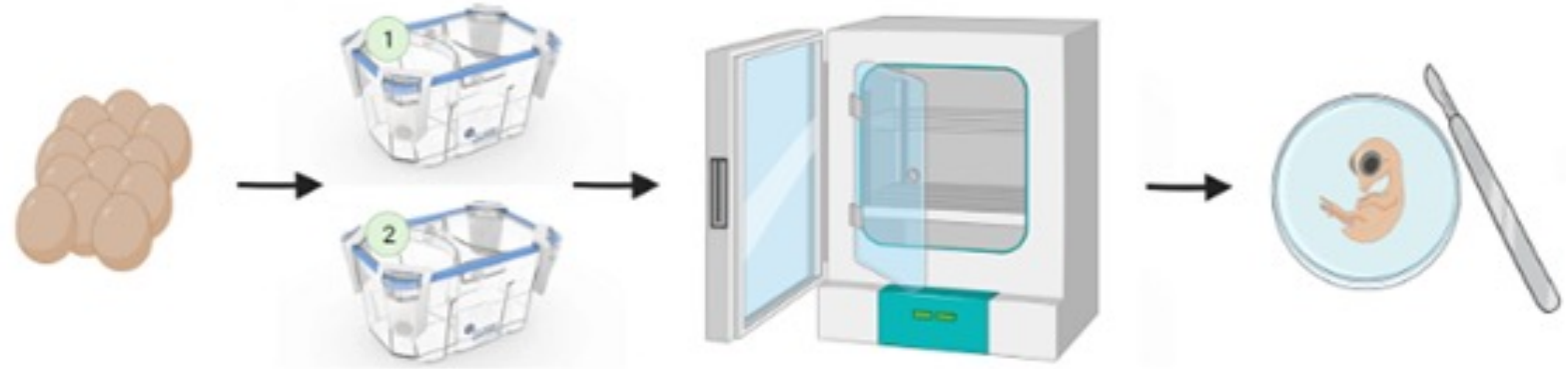
Upcoming project: overview

A



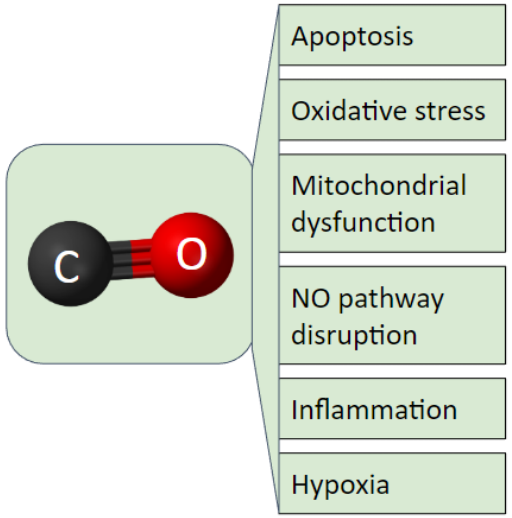
(A) Adult brain imaging examples; electroencephalography and transcranial doppler ultrasound.

B

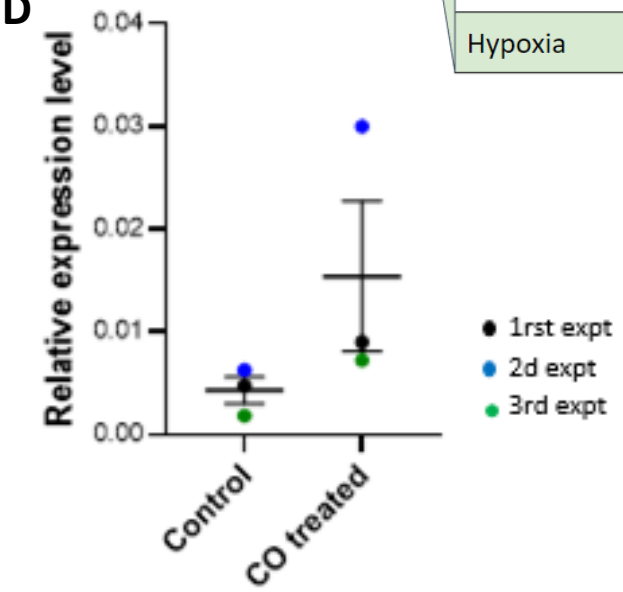


(B) Schematic of chick embryo workflow.

C



D



(C) Schematic of select possible pathways that low-level CO may impact. (D) Example preliminary data. Inflammatory marker CCL2 increased in human umbilical vein endothelial cells after ~25 ppm CO exposure for 4 days.

Thank you!

Dr Mari Herigstad
Dr Prachi Stafford
Dr Liam Ridge

Sheffield Hallam University

Dr Celine Souilhol
Dr Alex Knowles
Ms Lucie Wilson

Prof Marysia Placzek

University of Sheffield

Mrs Isabella Myers

Dr Chris Morris

Newcastle University

CO Research Trust
EVIDENCE • SAFETY • HEALTH